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THE INSTRUMENTS OF POWER: A COMPUTER-ASSISTED GAME FOR THE ACSC CURRICULUM

by

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A Research Report Submitted to the Faculty

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The ACSC curriculum could benefit from the addition of wargaming that focuses on teaching students about the employment of the national instruments of power (IOPs). Wargames and exercises addressing the relationships among the IOPs are available from both Government and commercial sources; however, they are often complex, resource intensive, time consuming to play, and/or not well suited for use on the scale required for all ACSC students to participate. As a result, they may not fit well within a time-constrained curriculum. Creating a game to fill this need is the purpose of this joint research project. This paper examines the need for strategic-level wargaming at ACSC, proposes requirements for a game to satisfy this need, and describes the game's software design. In a companion paper, LCDR Brian Tolbert, USN, addresses development of the game's rules, the political/military principles upon which they are based, play testing of the game, and recommendations for future game enhancements. By creating and testing the prototype, the overall feasibility of the concept can be evaluated without a costly and labor-intensive software development effort. Future versions could either directly build upon this work or be expanded into a professionally developed software suite.

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PREFACE

The author would like to acknowledge and thank those who contributed so vitally to this project. First and foremost, I wish to thank my wife, Amanda, and daughters Lauren and Heather for their patience and encouragement. To Matthew Caffrey and Charles Kamps, thank you for sharing your wargaming expertise and extensive library of gaming materials. Both were a tremendous help and gave our research team a much needed boost forward in focusing our efforts. I would also like to thank Lt Col Dan Novak, USAF, Dr. Edwina Campbell, and Maj Edward Allard, USAF, for their perspectives on strategic-level wargaming and numerous game design inputs. To the members of our research seminar, thank you for your numerous insights and comments on commercial games evaluated during our studies. Many of the resulting class discussions directly influenced the game's design. Thanks are also due to my fellow contributors to the MrExcel internet message board. Many long nights writing code were made significantly shorter due to their assistance. Lastly, I would like to acknowledge and thank my partner, LCDR Brian Tolbert, who was the visionary behind the game concept and prime rules developer. His vision and penchant for fun made this project a success, and I thank him for his patience while I worked through the technical aspects of implementing the game in software.

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ABSTRACT

The ACSC curriculum could benefit from the addition of wargaming that focuses on teaching students about the employment of the national instruments of power (IOPs). Wargames and exercises addressing the relationships among the IOPs are available from both Government and commercial sources; however, they are often complex, resource intensive, time consuming to play, and/or not well suited for use on the scale required for all ACSC students to participate. As a result, they may not fit well within a time-constrained curriculum. Creating a game to fill this need is the purpose of this joint research project. This paper examines the need for strategic-level wargaming at ACSC, proposes requirements for a game to satisfy this need, and describes the game's software design. In a companion paper, LCDR Brian Tolbert, USN, addresses development of the game's rules, the political/military principles upon which they are based, play testing of the game, and recommendations for future game enhancements. By creating and testing the prototype, the overall feasibility of the concept can be evaluated without a costly and labor-intensive software development effort. Future versions could either directly build upon this work or be expanded into a professionally developed software suite.

INTRODUCTION

The Instruments of Power (IOP) game was developed to satisfy the need for a strategic-level educational wargame that can be deployed in the Air Command and Staff College (ACSC) curriculum. The game illustrates some of the key interrelations of the four instruments of national power—Diplomatic (D), Informational (I), Military (M), and Economic (E)—by providing the players an opportunity to exercise them in a graphic, interactive game format.[1] The intent was to make a game that is easy to play, adaptable, educational, and fun. The game does not attempt to be a high fidelity political/military simulation, purposely leaving many features at an abstract level to speed play and help players focus on strategic concepts versus the tactical details of combat.

The characteristics of a strategic-level wargame suitable for use in the ACSC curriculum can be defined by analyzing course learning objectives, implementation requirements, and other educational constraints. Furthermore, a prototype of this game can be created and modified by students using readily available software and personal computers. By creating and testing the prototype, the overall feasibility of the concept can be evaluated without a costly, labor-intensive software development effort. Future efforts could either directly build upon this work or be expanded into a professionally developed software tool, using the concepts demonstrated in the project as a point of departure.

Throughout the course of the game's development, Major Lynn Anderson, USAF, and Lieutenant Commander Brian Tolbert, USN, collaborated on its construct and perspectives, for the purposes of presenting their jointly developed wargame, the "Instruments of Power." This paper explores the requirements for the game and describes its software design. To that end, it begins with a discussion of the current state of wargaming at ACSC and identifies a potential

need for strategic-level gaming in the curriculum. From the general statement of need, the paper goes on to propose a set of more detailed requirements that a game satisfying this need must meet. It then evaluates representative commercial and Government games and exercises against these requirements; both in an attempt to see if they could be used as-is and to find good ideas for incorporation in the researchers' game. Having identified a shortage of suitable games, it goes on to describe the construct and detailed design of a prototype computer-assisted game that could fill the gap in available games. Finally, the prototype is evaluated against the proposed requirements and recommendations made for its further development and employment at ACSC. The companion paper by Lieutenant Commander Tolbert addresses the course concepts that the game will attempt to reinforce, the relationships between the IOPs which are inherent in its rules, the research basis underpinning the rules, play testing of the game, and recommendations for additional game enhancements.

WARGAMING IN THE ACSC CURRICULUM

The benefits of exercises and wargames are multi-faceted and have been recognized in political/military circles for hundreds of years. The ultimate hope of practitioners was to "…prepare their rulers to outthink other rulers."[2] In the realm of modern Professional Military Education (PME), wargames can be "effective, engaging, reinforcing, and serendipitous" educational tools.[3] First, exercises are a "synthesis level educational activity."[4] In effect, they can encourage students to bring together multiple course concepts and practice them in an integrated fashion, all in a low-threat environment. Furthermore, exercises tend to encourage participation, perhaps bringing in those who are not as vocal in a normal seminar setting. They can even be competitive and fun, taking advantage of the natural competitiveness that is

prevalent in military officers. Exercises are "reinforcing" in the sense that they allow repetition of key concepts and make the participant's subsequent real-world experience feel more familiar when it occurs.[5] Finally, exercises can be by their nature "serendipitous," as they often put participants into unexpected situations that can highlight significant ideas that weren't necessarily thought of by the designer of the course.

Research also supports the value of wargaming in education. For example, doctoral research by Lt Col Steve Hansen, PhD, of the Air War College shows that exercises and presentation of course materials via audiovisual means can be very effective in improving retention. Students exposed to course concepts via audiovisual means showed 10 percent better long term retention of course material when compared to those presented with standard text-based course materials. In addition, subjective measures of student satisfaction significantly favored audiovisual presentations.[6]

Wargaming and group exercises have long been and continue to be a part of Air Command and Staff College (ACSC) courses. The Academic Year 2005 curriculum provides many examples. Classes in Leadership, Joint Planning, and Joint Air Operations all incorporate wargaming to help students see how course concepts exhibit themselves in simulated real-world environments.[7,8,9] The Specialized Studies Political/Military course even includes a multi-role strategic crisis action exercise; however this course is available to a fraction of ACSC students.[10] These games come in a variety of forms, from a manually adjudicated exercise[11] all the way to a web-based, multi-participant, computer-adjudicated game.[12] All have the objective of allowing students to experience communication and decision making in a simulated environment.

Though the benefits of wargaming are widely accepted at ACSC, it is not currently employed in all areas of the curriculum. Notable exceptions are the National Security (NS) and

Strategy and War (SW) courses.[13,14] Taught early in the academic year, these courses intend to expose students to the strategic level of thought and subsequently increase understanding of the international system, employment of the national instruments of power (IOPs), grand strategy, and the role of military strategy in international relations.[15] The IOPs presented in these courses are defined from the Diplomatic (D), Information (I), Military (M), and Economic (E) viewpoints, and refer to the primary ways in which nations and their leadership interact and attempt to influence one another.[16] These are considered to be foundational courses, upon which all subsequent classes build.

If wargaming is used widely throughout the rest of the curriculum, then why is it not included in these courses? Multiple interviews and discussions with ACSC faculty members highlighted the lack of time available for play as a significant factor.[17,18] The NS and SW courses are taught within a compressed academic schedule. Each of these graduate-level courses is approximately five weeks long, meeting two to three times per week. The amount of material to be covered in the allotted time is extensive. For example, in the NS course there are 24 lectures, 15 seminar meetings, and hundreds of pages of assigned reading covered in the five-week schedule.[19] As a result, any game or exercise that took more than one or two dedicated class days for students to learn and play would make it very difficult to cover all of the other course material without expanding the overall course schedule.[20]

ACSC faculty members identified other factors, though probably issues for wargaming applied to any part of the curriculum, which appear to especially apply in this situation. In addition to speed of play factor, "developmental lead time" can also be an obstacle.[21] It can take substantial time to either create a custom-designed game or modify an existing one for the specific need, and then implement it in the curriculum. For example, the Air Force Wargaming

Institute (AFWI) supports a number of wargames held at the various Air University schools. Per Air University Operating Instruction 36-2201, the process for developing and employing a new game will take 15 to 24 months. Even the modification of existing AFWI games requires a 12-month cycle.[22] If faculty were to pursue an approach using commercial games, there are still hurdles to overcome. It can be difficult to "…find, create, or adapt applications that support lesson objectives."[23] When such a game is found, it is likely to be complicated and time-consuming to play. As discussed later in this paper, this perceived lack of games appropriate for the ACSC application, especially the NS course, appeared to the researchers to be true at the outset, and as discussed more at length later, seems to be founded. The "lack of facilities/resources" to execute can also be limiting, especially in the case of large scale computerized games.[24] Those currently employed in the ACSC curriculum require rooms, displays, computers, software and databases, information technology (IT) support, game controllers, and other support staff. All of these components require substantial commitment of both time and funding to bring together into a coherent event. Finally, "changing educational objectives" levy requirements on a game to be flexible and easily adapted to new course content without having to accomplish lengthy and expensive revisions.[25]

These obstacles can and should be overcome, because the learning benefits can be substantial. Like other parts of the ACSC curriculum, strategic-level courses should be gaining the benefits of wargaming. Though the key interrelationships among the IOPs are discussed at various times throughout these and other ACSC courses, there are no focused activities that truly allow students to experience them first hand and integrate the full spectrum of course ideas. As a result, students are charged with creating their own "mental model," or set of "deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the

world and take action" to synthesize the concepts taught.[26] This must be done based upon exposure to multiple readings, lectures, and class discussions, without the benefit of reinforcing experiences. The researchers believe that gaming could have a positive impact on students studying the strategic level, helping them internalize the relationships among the IOPs and providing the "synthesis level activity" that is currently missing from this part of the curriculum.[27] By developing an educational game that attempts to consolidate these concepts within its rules and game play format, relationships can be experienced, not just read, heard, or imagined. Students, through simulation and role playing, should gain a better understanding of these linkages and what affects they can garner when used in concert with one another.

GAME REQUIREMENTS DEVELOPMENT

Once the researchers had developed a sense for the place of gaming in the overall ACSC curriculum and the primary need and implementation issues to be addressed, a preliminary set of requirements that could further guide game selection and/or development were derived. In keeping with the author's systems development and engineering background, these requirements were analyzed further to discern their relative importance. Some of them were critical, being absolutely necessary if a game were to be used in the curriculum. These are referred to as "thresholds." Others were nice-to-have or simply the preference of the researchers or those interviewed during the course of the project. These are referred to as "objectives." Upon consolidation of multiple discussions with ACSC instructors and research seminar classmates, the researchers came to the following generalized conclusions regarding top-level requirements that the game must satisfy.

Valid Educational Content (Threshold). First and foremost, the game's content must have educational value in the context of the course. If it doesn't, why bother to employ it? In terms of software development, the researchers interpreted this to mean that the software must accurately implement rules and relationships that are consistent with course concepts. As such, the outcomes of actions and events within the game should provide evidence of this consistency. Lieutenant Commander Tolbert's paper provides the basis of the rules and their link to course concepts, so this paper will not significantly expand upon this further, other than to describe the process used to ensure consistency between the game software and rules.

Takes less than one day to prepare, play, and debrief (Threshold). If this is not feasible, then the game could alternatively be designed for continued play over a long period of time, allowing players to stop and resume play until the game is complete. This could be expanded even further to span several courses within the curriculum. This requirement, as will be seen later, drives both the game construct and its detailed design. Items such as clarity and accuracy of the rules, human factors, and software functionality (in the case of an automated game) all will be affected. If the game were offered to students as an optional activity, the researchers believe that regardless of the game's format, the chances of students trying the game will increase if it is easy to set up and play, perhaps during breaks between scheduled school activities.

Support multiple players, either within a single seminar or across multiple seminars (Threshold). This allows the game to be an interactive learning experience and forum for discussion of course concepts, not just an exercise in figuring out the best way to beat a computerized opponent. In effect the game acts as a medium for students and faculty to interact in an environment where course concepts are the central focus, with the interaction itself equally

or more important than the fidelity of the game. Game play by many simultaneous users across a network may be desirable.

Does not implement artificial intelligence (AI)(Threshold). The researchers quickly concluded that developing AI for the game would be beyond their current capabilities and not achievable within the time allowed for research. As a result, a conscious decision was made that the game would not be playable against the computer. This would make the game fall into the category of computer-assisted, versus being fully computerized.[28] The players provide all of the intelligence and decision making, while the computer keeps score, ensures that the players cannot take actions not allowed under the rules, and possibly aids the players by dealing with the injection of random events and other probability-based items, such as combat adjudication.

Lectures and discussions also pointed out that strategic-level wargames and exercises often involve political and social elements far too complex to accurately model. Games using Bunch of Guys Sitting Around a Table (BOGSAT) adjudication or expert referees/arbitrators are often used to explore these complex relationships.[29] A computer-assisted game was deemed to fit into this construct better, since there might be more emphasis on the role of the players and their abilities to synthesize and employ a multitude of concepts than on complex computer algorithms that probably will not reflect reality anyway.

Low cost (Threshold). The researchers had no budget available for procurement of either programming support or software development tools. Furthermore, it was assumed that any initiative which has significant long-term costs would not get past the proposal phase unless its benefits could be proven first with an inexpensive demonstration. From the software development platform to the thoroughness of documentation, every effort would need to be taken to minimize overall project cost and to provide a product that could be used or modified with a

low level of effort. If the game's concept could be proven through demonstration of the prototype, then the potential for more robust funding and/or a formalized program with AFWI support could be pursued later.

Be able to create and play different scenarios (Objective). Since educational objectives and the world situation are constantly evolving, the game should be adaptable in order to avoid becoming obsolete and to provide variation so students aren't playing the same scenario every year. In addition, the game should allow the creation of scenarios that focus on different aspects of the international system. For example, alliances, imbalances in power, or geopolitical issues could possibly be emphasized be configuring the game in different ways. For a computerized game, users should be able to create scenarios easily without the need for a costly, time consuming software modification.

Have variety of means to show participants/players what is happening, both during play (Threshold) and after game is completed (Objective). This was a common theme in discussions, especially in the context of the researchers' past experiences with existing computerized strategic-level games. Players are often not privy to what it is they are supposed to be learning. As a result, many games leave the player wondering whether outcomes are due to their own actions, the actions of their computerized opponent, or chance. As a result, the researchers deemed it important to provide a variety of ways for players to collect the information they need to weigh the benefits and risks of potential actions, as well as to see how their actions drive outcomes.

Entertaining to play (Objective). This was a self-imposed requirement from the researchers' perspectives; especially if the game is provided to students as an optional activity during the course. As ACSC students, we have seen first hand the time constraints within the

curriculum. Even though students welcome diversions from lectures and readings, those diversions are unlikely to be pursued if not entertaining. Furthermore, if possible we wanted to capitalize on the addictive nature of many of today's top computer games. They include audio-visual features and other clever facets to enhance game play and reward players with an entertaining, humorous, or visually pleasing experience.[30] Whether the end product was a board game or computerized, capturing this element in some way was considered an important.

REVIEW OF OTHER STRATEGY GAMES

"All models are wrong. Some models are useful."

- George E.P. Box

Re-invention is a common pitfall, so review and play testing of other wargames was identified as a key activity early in the project. The researchers' rationale was twofold. Though the initial thesis was that a new game was needed to suit the needs of the ACSC curriculum, it was possible that a game meeting the identified need already existed or could be created via minor modifications to an existing one. In the event that there were no games that filled this niche, then the best ideas and features observed could be incorporated in the new product. The games mentioned below are only a subset of those reviewed and are highlighted because they are either representative to the genre or particularly contributed later to the design of the IOP game.

The researchers first looked at the realm of commercial computerized games to see if a suitable product meeting the requirements was available. Several commercially available products that provide an extremely detailed portrayal of the issues and decisions encountered by a national leader in employing the IOPs were found. Unfortunately, none of the products in that category met the speed and playability objectives of the project.[31] First-hand experience with

some of these games, such as *Civilization III*[32], *Superpower*[33], and *Rise of Nations*[34] indicates that it can take several hours of study and play just to familiarize a player with the game's features. To truly become a proficient and gain insights from the games, a great deal of play over an extended period—weeks or even months—can be required.[35]

Play testing of commercial games by the researchers also revealed content issues that could impact their effectiveness as educational tools. Some computer games, such as *Risk II*[36], were relatively easy to play and set up, but were lacking in breadth of content, for the most part focusing only on military actions. On the other end of the spectrum, the level of fidelity was such that it could actually be considered a disadvantage. The NS and SW courses attempt to keep students' thinking at the strategic level; however, these games often include decisions down to the tactical level, supported by huge databases of detailed information. *Superpower*[37] is a prime example of this type. Though the game strives admirably for realism, the raw magnitude of data and options available to the player makes it rather daunting to play and easy to get very focused on detailed information, such as that involved with configuring military forces.

Visibility into the "why" within many commercial games can also be an issue. In most of the games played, it is not always apparent why certain events occur, and whether or not they are due to the player's actions, the actions of the opponent(s), or chance. As such, it can take extensive amounts of play to understand how strategy ultimately impacts outcomes and subsequently reinforce the desired concepts.

Given time, these games and others like them could provide an outstanding educational experience. Many are meticulously researched and employ very realistic portrayals of governments, societies, technology, and military forces. Furthermore, despite the basic problems discussed above, the games reviewed had many attractive features from an educational

viewpoint. In many cases, users are allowed to set up unique game scenarios, which can make them adaptable to changing objectives. Most allow multiple-player games, some over the internet, which is a plus for an application such as ACSC, where one could envision a scenario where seminars organize themselves as a nation's senior leaders and match wits with other seminars. Play could be organized in a myriad of ways: at the individual student level, among students in a single seminar, or across several seminars, all using existing facilities and computer resources. Many also allow players to save and resume games later, enabling play over an extended timeframe. The most entertaining commercial games incorporate graphics, sounds, and animation or video to enhance the play experience and provide entertainment value. Finally, commercial games are cheap and accessible. For approximately $30 each, every student could have a copy of one of these games accessible at any time on their computer. Though $18,000 ($30 x 600 students) might seem expensive, the cost of a custom-designed game could quickly exceed this figure, since $18,000 in today's market buys approximately 1/5th of a man-year.

In a similar fashion, government-sponsored games and exercises which involve players at the strategic level also exist. Examples of these include the Air War College's (AWC) Joint Land Aerospace and Sea Simulation (JLASS)[38] and the Army War College's (USAWC) Strategic Wargaming Facility (SWF).[39] Both of these capabilities provide environments where students can participate in simulations of decision processes at the national level. Players assume the roles of a variety of Joint and Interagency entities, and are provided with realistic communication and decision support systems to add fidelity to the exercise.

As applied to the ACSC requirements, the logistics involved with taking nearly 600 students through one of these exercises would be extraordinary. For example, JLASS is an AWC elective that includes all six senior-level service colleges, with 90 students participating in

one large game, playing at the Combatant Commander, Joint Staff and Interagency levels.[40] Scaling this exercise to handle 600 students would be difficult, especially since it relies on manual adjudication by subject matter experts (SMEs) who would probably be overwhelmed supporting six simultaneous games. Unlike JAEX, which is played by all ACSC seminars simultaneously, the student body would probably have to break into several groups to play, which ultimately would create significant scheduling issues for the rest of the curriculum.

Not unlike the commercial games reviewed, the Government games and exercises have a high level of fidelity and undoubtedly offer excellent educational experiences. On the down side, they are resource intensive to the extent that they are probably unsuitable for a school the size of ACSC, and better left to their original purpose of preparing senior military and civilian leaders for duties at the operational and strategic levels.

Summary of Strategy Game Review

The search for an educational game meeting the stated requirements did not identify a suitable alternative, though it is certainly possible that one might exist and the researchers simply did not find it in the time available. There are commercial games available that met some of the requirements, but they are very time consuming to play and many of the specific goals are lost on the difficulty of play and intricacies of the game. Other commercial games examined met playability objectives, but were too focused on combat-like activities. Existing Government games and exercises sampled offer exceptional experiences for students, but are probably not feasible for use in a school the size of ACSC. Based on this assessment, the researchers continued on in their attempt to develop a game that addresses these shortcomings.

Many of the games examined had useful educational features and provided some insight into the development of the IOP game. Although some of the games examined provided some of

the framework for the creation and development of the IOP computer software, they had to be significantly altered in order to meet the desired educational objectives as well as meet the game's playability requirements.

GAME CONSTRUCT

The IOP game was originally conceived as a tool for demonstrating the various interrelations of the four IOPs. At the project's outset, it was envisioned that the concept would be demonstrated as a board game that incorporated some of the features of games evaluated by the researchers, with the addition of rules and features that would more directly expose players to NS course concepts and allow them to experience employment of the IOPs. After assessing several strategy games, reviewing course materials, and multiple brainstorming sessions, relevant materials and concepts were transformed into a draft game concept and rule set.[41] Once the board game was developed, a plan for automating the game would be proposed.

As the initial rules were edited and developed further, the researchers concluded that the resulting board game would be complex and place a large "bookkeeping" load on the players just to track scores, maintain the status of territories and military forces, track the status of treaties, and keep the players from taking actions prohibited by the rules. Initial calculations indicated that there would be approximately 24 scoring and status items per player and nearly 600 pieces of information required to track the status of the game's 46 geopolitical areas. This led to the idea of a board game accompanied by a spreadsheet that would help the players keep score, handle random events such as dice rolls, and perform error checking to aid in rules compliance.

Upon further study on how to best incorporate the desired functions in a spreadsheet and more analysis of the objectives for the game, we concluded that it would achievable, though a

challenge, to implement the game board, scoring logic, and rules in software, incorporating graphical user interfaces (GUIs). The game would still be computer-assisted, not allowing player versus computer games; however, it would strive to have some of the graphics features of a fully computerized game. The expected benefits for the prototype effort were two-fold. First, providing players with an intuitive game GUI would probably significantly add to the game's speed of setup and ease of play. Second, a GUI might enable the use of graphics, videos, and other features that might make the game more entertaining and fun to play. Though entertainment value was not a threshold requirement, the researchers felt that every effort to make the game entertaining would result in both increased likelihood of the game being adopted in the curriculum and subsequently more likely to be played by faculty and students.

DETAILED GAME SOFTWARE DESIGN

Software Development Platform

The researchers did not have funding to procure software licenses, so the range of options was constrained to what could be obtained free of charge via existing licenses available to ACSC students. After consulting with the ACSC Faculty Help Desk and conducting further independent evaluations, the author settled on Microsoft®[42] Visual Basic for Applications® (VBA) 6.3[43], combined with a Microsoft® Excel®[44] 2002 spreadsheet, as the project's development platform.

There were multiple factors influencing this selection, all of which can be traced back to the game's requirements. First was cost and availability. Since VBA is embedded in Excel®, it has no additional initial cost and is available on nearly every computer at ACSC. Furthermore, future upgrades and maintenance would be included along with periodic Excel® upgrades. In

terms of adaptability, VBA is a widely used, modern computer language with syntax and programming concepts that would be familiar to almost any programmer who might attempt to modify the software later. An additional benefit of VBA is that the code could be easily modified to work with a Microsoft ® Access®[45] database or as a stand-alone application if deemed necessary. For ease of use and expediency, the author already had some limited exposure to VBA and extensive experience with Excel®, which was critical given the short timeline for the project. Yet another advantage was that multiple sources of programming documentation and internet-based VBA software developer forums, such as the MrExcel message board, were available.[46] These turned out to be critical and aided the author in solving numerous problems during software development. Finally, VBA supports a variety of multimedia and graphics functions, to include animation, video, and audio.

Development Methodology

Once a preliminary set of objectives, rules and the game's general construct were developed, the next task at hand was to determine if we could actually develop and demonstrate the associated computer-assisted wargame. Given the compressed timeframe for the project, the researchers decided to use an iterative software development process, where the game specifications (rules) and software evolved concurrently, gaining levels of detail and functionality as the process went along. This resulted in increased synergy between the rules and software development activities, increasing the chances of finishing the project on time. Furthermore, it was much more likely that the final software would accurately implement the game rules. In the software engineering field, this is often referred to as a "Spiral" development process.[47] Figure 1 below illustrates how this type of process works.

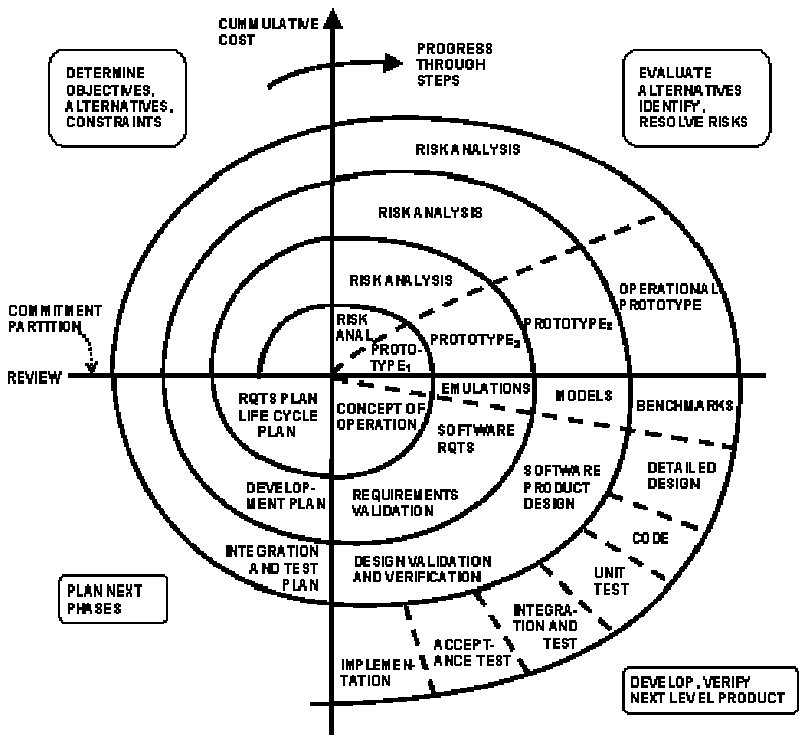


Figure 1. **Spiral Development Process Diagram**[48]

A streamlined version of Boehm's process model was used to develop the IOP software. Once the initial requirements, rule set, and game construct were decided upon, the first prototype of the game was coded. This prototype simply included examples of possible user interface screens. Once complete, the interfaces were reviewed, changes and additions for both the software and rules identified, and a set of functions for incorporation in the next prototype were chosen. This process ran continuously for nearly three months, with a new version of software released approximately every one to two weeks until the final prototype was coded and guided play testing was complete.

Boehm highlights the idea that one of the strengths of spiral development is its ability to identify and reduce risk in software projects.[49] In the case of the IOP game, we saw several examples where ideas included in the original game concept were dropped once experience was gained with a prototype version. When a concept was deemed difficult to implement and not

central to the game's objectives, it was dropped. Insurgent armies, though a feature that both researchers wanted in the game, fell into this category.[50] Conversely, as the researchers experimented, several features were discovered that were simple to incorporate yet added depth and richness to the game. Information warfare, the Spy, score trending, and the ability to view game map screen captures during post-game debriefs are just a few examples.

In parallel with the software development process, the researchers spent significant time playing and reviewing existing automated and board games, looking for those that would provide training and value in the employment and demonstration of the linkages between the various instruments of power.[51] As the process proceeded, several good ideas from existing games were incorporated. The best concepts from those games examined were taken, refined and restructured, ultimately being implemented in the software. Consistent with our development methodology, some of the concepts were eliminated, simplified for purposes of the prototype, or identified for future consideration.

A computerized wargame typically should have a specification by which the programmer can then design software.[52] For that matter, this researcher's experiences from several defense research and development programs suggests that any successful software development project needs requirements defined at a sufficient level of detail to allow the programmer to create code that accomplishes the desired functions. As noted above, the game rules effectively became the primary specification. The vast majority of the algorithms that would be coded in software were derived from them. By design the rules were not a complete requirements set, since many requirements are not of interest to the players. As such, Appendix I was developed to augment the rules, adding detail where necessary so the researchers could compare the finished product's features and functions to the original requirements.[53] Due to time constraints the researchers

chose not to write more detailed documentation beyond this point, deciding instead to include detailed documentation within the software code and Excel® database itself. An exception was made later to ensure that users could solve basic technical issues when installing and playing the game. The decision was made to provide a "Quick Reference" guide with step-by-step instructions for computer configuration, installation, game setup, and saving games for future play. This guide is shown in Appendix III.

Game Software Design Overview

As graphically depicted in Figure 2, the final computerized game has four primary components, the exact structure and content of which would evolve during game development. These are the DIME_BETA workbook, auxiliary multimedia files, the Game Setup GUI, and the Situation View GUI. The following section describes these components and how they fit into the overall flow of the game's setup and play, while an expanded set of figures depicting the game's structure is available in Appendix II.

As described by Dunnigan, "the foundations of any automated model are its data bases."[54] In this case a Microsoft® Excel® workbook containing a series of worksheets with scoring data, country information, random events, reports, and graphs serves this purpose. The major components of the database and their contents are enumerated in Figure 2. The VBA software developed for the project is basically a very sophisticated Excel® macro. As a result, the workbook also stores all of the VBA code, which conveniently keeps the software and the data that it acts on in one location.

In addition to the basic game database, three primary types of auxiliary multimedia files are necessary for the full functionality of the game software to be realized. The first of these are

the leader profiles. The six profiles provided with the prototype are brief biographies on each leader that will aid players in games where role playing is encouraged. The files themselves are

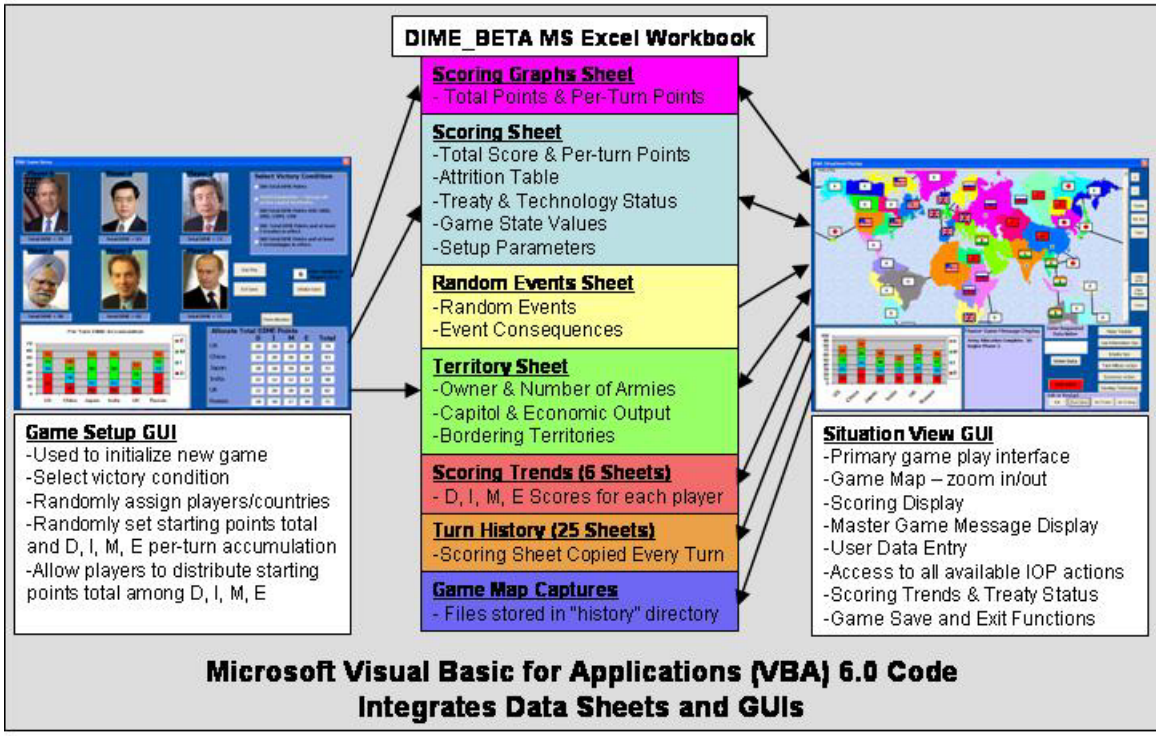


Figure 2. **IOP Game Components**

in the hyper text markup language (HTML) format and are accessed during game setup by clicking on the photo of the desired leader. In order to mark territories as belonging to a particular player, a national flag icon image for each of the six nations is included and loaded by the game any time a territory is occupied or taken over by that country. Finally, the game data set includes a number of video files that are played at various times during game setup and play.

To keep the game GUI uncluttered and simplify programming, the author decided to break it into two major components; the Game Setup and Situation View GUIs. The researchers' critiques of existing computerized games largely centered on their level of complexity and relative lack of clarity and instructions for the user, so extensive attention was paid to the content of the GUIs during their design to make them as clear and user-friendly as possible. As such,

three principles, derived from GUI design guidelines proposed by Wallace Wang, were kept in the fore.[55] First is ***sufficient feedback***. We did not want to leave the player wondering what just happened, or why. Furthermore, we wanted to provide enough information to the players to help them make intelligent decisions. ***Clarity*** was also deemed critical. Many games reviewed offer a great deal of information to the player, but it is not always possible to decipher its true meaning or relevance in play. Finally, in keeping with the objective of an entertaining game, ***entertainment value and aesthetics*** were always kept in mind. This included the selection of videos, colors, size and shape of graphics, and the wording used in messages and user dialogues.

The Game Setup GUI was incorporated to allow setup and initialization of the game, as shown in Figure 3. It aids the players by running code that randomly assigns each player (two to six players total) one of the six available national leader roles and initial IOP starting points. Using functions on this GUI, each player can then allocate their total IOP points among the four categories of the DIME prior to the start of play. The code also ensures that there are no errors in allocation of points prior to allowing the start of the game. Multiple computerized games provided some level of inspiration for this GUI, as most have some type of similar function, though its layout, overall appearance, and functions were created uniquely for the IOP game.

Figure 3. **Game Setup GUI Overview**

The Situation View GUI shown in Figure 4 is the primary game play interface, containing the game map, scoring and status displays, game command and data entry functions, and text and video displays to provide other information to the user. Once the game has been initialized in the Setup GUI, the Situation View GUI is presented to the players. For those who have played either computerized or board versions of *Risk*[56], the Situation View GUI will look familiar. The geopolitical map contains 46 divisions and is based largely on multiple versions of *Risk* reviewed by the researchers, with some modification to simplify software coding. The message display was inspired by *Risk II*[57], while the remaining scoring and status graphs and lower-level GUIs used for employing particular game functions were specifically designed to implement the game rules. Players will first take actions to and array their military forces into the unclaimed territories of the map. Again, this sequence borrows from *Risk II*. Once territories are selected and forces arrayed, the game is ready to begin. Players take actions through various phases of their individual turns, initiating diplomatic actions in the form of treaties, using their information power to influence situations, exerting military power through combat and occupation, and increasing their development through economic growth and occupation of additional territories. Throughout the course of play, feedback and instructions for the players are presented in the Master Game Message Display and pop-up dialogue boxes.

At the conclusion of each round of play, the software will randomly select a global event from the database and display it to the players in the Game Master Message Display. This event may affect all players or a single player, generating both positive and/or negative effects. These events are designed to stimulate play and interaction among the affected players, driving diplomatic, military, and economic actions.

Figure 4. **Situation View GUI Overview**

In addition to basic game play functions, text, and graphic displays, context-specific videos are displayed in the Situation View GUI at certain junctures of the game. Though these often provide useful information to the players, their main purpose is to provide entertainment value above that which a map-only game would provide.

The game will continue through the turn taking process with players conducting their DIME actions until a player achieves one of the pre-determined victory conditions. The victory conditions may be point driven, event driven, or territory driven. The first player to achieve the selected victory condition and maintain it for one turn is the winner of the game.

Other Educational Features

As covered in the previous discussion of game requirements development, additional features that could prove themselves valuable for an educational game were identified. These were all implemented in varying degrees within the prototype software. Scenario building and debrief capabilities are prime examples of such features.

Early in the project the desire for the ability to play out different scenarios was expressed.[58] Initially, the researchers believed that scenario building might be beyond the scope

of the project and programming capabilities of the author; however, as the project has progressed, some limited inherent capability has evolved within the game. First, the software design allows the players to save, exit, and reload their game. All of the relevant data for the game is stored in the Excel® workbook, so it is theoretically possible to manually modify the data, save the file, and then use the game's "Resume Saved Game" feature to load the custom scenario. The author has done some preliminary work with this concept with positive results. As discussed in the next section, more work is required to make this feature truly usable.

Another educational capability that faculty members identified as useful was the ability to review the progression of the game, both during play and in post-play "hot wash" sessions.[59] The anticipated benefit was that having game data available would facilitate group discussion within the seminar, allowing faculty and students to review actions and outcomes in the context of the course material. As with scenario building, the researchers were ultimately able to incorporate this type of capability without significant additional effort.

For feedback during game play, a score trend display was created, accessible from the Situation View GUI. At the end of each turn, every player's D, I, M, and E scores are saved to a sheet in the Excel® workbook and plotted on a line chart. Players can view their chart during their turn by simply clicking a button in the GUI. This information could be useful for reviewing actions taken and their effects and for facilitating instructor and peer feedback regarding actions that might have worked better.

For post-play feedback, a lucky foray into the MrExcel internet forum uncovered an existing software routine that was adapted to take a screen capture of the Situation View GUI at the end of each turn.[60] Though this was useful for seeing the overall geopolitical situation on the map as the game progressed, it did not provide all of the data necessary to determine why things

occurred during the turn. To solve this problem, code was added to make a copy of the scoring sheet and save it in the database at the end of each turn. In this way, more detailed information can be obtained to reconstruct what happened. Examples include changes in diplomatic relations between countries and technologies developed or obtained via espionage.

DESIGN ASSESSMENT AND RECOMMENDATIONS

Appendix I was used not only to guide development, but also to provide a means to assess the final product against the identified requirements. As development and guided play testing were conducted, information was added, to include the design features that address each of the game's requirements, the methods used (or proposed) to verify compliance with the requirements, and status of verification. The following provides a summary of this assessment.

At the overall project level, it was difficult to completely assess the game versus every requirement, given very limited unguided play testing as of this writing.[61] It is expected that play testing will continue on well beyond the writing of this paper. The researchers' preliminary assessment, shown in detail in Appendix I, suggests that the project met all of the stated threshold requirements and many of the objectives. So far, the researchers have been very pleased with the game's playability, both in terms of speed and ease of play. The project was able to incorporate a vast majority of the original rules, and eventually included several more features demonstrating an even broader sampling of IOP relationships as development progressed. The software has proven to be more adaptable than originally planned, supporting limited scenario generation and post-play debrief features. Other than the researchers' time, the game was developed at no cost. Finally, testers to date have enjoyed playing the game. Feedback has suggested that the user interface, though having areas for improvement, is simple

and enjoyable to use. The selection of videos and inclusion of humorous wording within the Master Game Message display and end-of-turn random events have garnered positive responses.

Though the researchers would contend that the prototype made substantial progress towards a game suitable for the ACSC curriculum, it does have some notable limitations that could be addressed in future efforts.

Rules Modification. The prototype was verified through extensive testing to accurately implement the game rules. However, it should be noted that the extent to which rules can be modified without software changes is limited. For example, attrition rates, costs and long term impacts of treaties, economic values of territories, number of initial territories per player, and rates of D, I, M, and E points accumulation can be modified via database changes. Though this provides a level of flexibility, there are no provisions for changes to the logic for rules corresponding to these data items without modifying the software.

Scenario Building. Scenarios can be built by an experienced user; however, it is not an automated process and could be significantly improved. The user must use a combination of the current Game Setup procedure and manual manipulation of portions of the database to set up a given scenario. Detailed procedures or an automated process for accomplishing this through one of the GUIs are yet to be developed. The author intends to continue work in this area.

Development Platform. Though the VBA/Excel® platform is inexpensive, convenient to work with, and supports sufficient features for the prototype, it may place limits on future expansion. Specifically, web-based, multi-player games or the addition of features that require a more complex database might drive selection of another software platform. This was seen as a possibility from the outset, so great care was taken to provide extensive comments to the VBA code to simplify conversion to another platform. Further research regarding the best long-term

software development platform was deemed beyond the scope of this project due to the capabilities of the author, time available, and the fact that the primary research objectives could be demonstrated with the chosen architecture. This area is a potential subject of future efforts if the game is to be operationally fielded at ACSC.

Multi-Player Design. The current software design allows multiple players, but distributed play over a network is cumbersome. It requires players to open the game, take their turn, close and save the file, then notify the next player to proceed. Players on multiple computers cannot access the application simultaneously. In contrast, current web-based games used in the ACSC curriculum, such as the suite used in the JAEX, provide a much better integrated distributed experience using web-based applications. The author attempted to make the game playable by multiple players simultaneously over a network; however, the work quickly encountered technical issues that were unsolvable within the time allotted. Further research could concentrate on how to best adapt the IOP game to such a format.

STEPS TOWARD IMPLEMENTATION

Given the current state of the game rules and software, the final question to be addressed is, "where do we go from here?" Several steps are still necessary to make the IOP game a fully accepted educational tool for ACSC. First, play testing involving members of both the faculty and student body must be completed. The plan for this testing is detailed in Tolbert's paper. Play testing should not only serve as a way to debug the software, but also allow the faculty to evaluate the educational usefulness of the game. Once complete, any necessary design changes or error corrections identified must be incorporated into another software release.

Depending on feedback from play testing, a decision must be made regarding how the game will be used. Will it be used as-is, as a point of departure to develop a Wargame Requirements Document (WRD) that AFWI can turn into a formally developed product, or not at all?[62] Since this question may not be completely answerable at the conclusion of play testing, the author proposes just one of many possible ways forward for consideration.

For AY 2006, the game could be deployed along two parallel paths. The first path would be to include the game as an optional activity in conjunction with the NS and SW courses. Similar in concept to an optional reading, the software could be offered to students via the ACSC Cyberbook (on-line academic calendar). To heighten awareness of the game, it could be "advertised" to students by both lecturers and Course Instructors (CIs). CIs could even be encouraged to use it in their individual lesson plans where appropriate.

The first path involves voluntary participation, so it cannot be solely relied upon for a complete evaluation. Therefore, the second path could be a pilot program using a small number of seminars. Due to the current limitations of the software, the best choice for play format would be one game per seminar, with the seminar members forming into two to three-person teams, each team playing one country. The seminar could either be presented with a faculty-generated scenario or play a normal game. After conclusion of play, the students and CIs should be surveyed to collect information regarding the perceived educational benefit of the game. Information garnered from the surveys could be used to determine whether the game should be a mandatory activity for all students in AY 2007 or remain as an optional activity. If desired, the game design and lessons learned from the pilot program could be used to generate a WRD for an AFWI-supported game at that point.

The approach described above is a conservative, incremental one that can obtain the information necessary for a disciplined implementation of the game in the curriculum. Its primary advantage is that the game can be evaluated in an actual educational setting while minimizing the use of faculty resources and disruption of the academic schedule. In addition, the pilot program can provide valuable experience to improve the game's effectiveness once implemented across the entire student body. Its primary disadvantage is time, as full inclusion in the curriculum will not occur until AY 2007, at the earliest. Ultimately, the approach chosen will largely depend on buy-in of the concept by the faculty and school leadership.

CONCLUSIONS

The Instruments of Power game is designed to give ACSC students an interactive tool for experiencing the various DIME elements in a competitive peer environment. Although there are some complex computerized games available that meet some of the educational and interactive requirements, they are very time consuming to learn and play, with the intricacies of the game often clouding the objectives. Other games examined were too focused on combat and combat like details instead of an integrated strategic portrayal. For these reasons, a prototype of the IOP game was developed to demonstrate a game that suits the ACSC curriculum, reinforcing the desired strategic-level concepts. The good features of several games and exercises were examined and combined with several original ideas from the researchers, ACSC faculty, and fellow students in the development of the prototype computer-assisted game.

The IOP game software was developed in an iterative fashion, starting with top-level requirements for its educational content and features, playability, cost, adaptability, and

entertainment value. Its design was carefully considered from several perspectives throughout to ensure that the finished product would be usable in the ACSC curriculum.

Throughout the development process, the IOP game has developed into a usable product capable of meeting the intent and objectives of the researchers. The deliberate approach used in conducting the play testing, spending time working through the actions of play, revising/refining the rules and coding, and capturing the corrections for revision have been key to producing the game and the current level of its playability.

The researchers have conducted a preliminary assessment of the game's features and functions versus the project's stated requirements, and believe that the finished product, though having limitations, can still be a very useful addition to the set of ACSC educational materials. It portrays a wide range of key course concepts, is easy to set up and play, and provides a variety of entertaining features to gain and hold the attention of students and faculty alike.

There are many possible paths forward for inclusion of the IOP game in the ACSC curriculum. The one proposed by the researchers includes both voluntary participation by the entire student body and a limited pilot program involving mandatory participation by a small number of seminars. This approach provides the information needed for the faculty and school leadership to intelligently chart the best future path for strategic-level wargaming at ACSC.

APPENDIX I: IOP GAME REQUIREMENTS VERIFICATION MATRIX

Game Requirement	Features That Satisfy Requirement	Verification Means	Verification Complete
1. Valid Educational Content			
a. Rules Implement Course Concepts	Rules based on research of IOP relationships taught in ACSC courses	Review of rules	Yes
b. Software Implements Rules	Software code and algorithms were developed in conjuction with the rules to ensure consistency	Manually verify results during code development, guided play testing and debugging.	Yes
	Algorithms and rules literally match each other	Manually verify results during code development, guided play testing and debugging. Save game database after an action related to the specific rule has been taken and manually calculate expected result. Compare to actual game result.	Yes
2. Takes less than 1 day to set up, play and debrief (not including scenario development)			
a. Set up	Simple Game setup screen with limited number of player-determined setup parameters. Prompts and information included to aid players in initialization of the game.	Timed setup of maximum number of players (6). Depends on player speed in decision making, however researchers were routinely able to set up 6-player games in less than 15 minutes.	Yes
	Setup includes hyperlinks to world leader profiles that can be used as a quick reference for players in games where they might be asked to role play a particular leader.	Manually verify results during code development, guided play testing and debugging. Click on leader images to display leader profile and verify software functionality.	Yes
	Software code automatically handles setup-related random selections.	Manually verify results during code development, guided play testing and debugging.	Yes
	Graphic indicator if initial points are incorrectly allocated among the IOPs. Error checking logic within setup screen to ensure a valid game initialization prior to play.	Manually verify results during code development, guided play testing and debugging. Check to see that 1) game will not start if victory conditions not set; 2) game will not start if initial player-selected allocation of victory points is not correct.	Yes
b. Play	Game rules embedded in software logic which disallows prohibited actions, making knowledge of game rules less critical for play.	Manually verify results during code development, guided play testing and debugging. Save game database after an action related to the specific rule has been taken and manually calculate expected result. Compare to actual game result.	Yes
	Master Game Message display that prompts players regarding the results of actions and what their next action should be.	Observation during guided play testing and debugging.	Yes
	Inclusion of game information and hints regarding what will happen if certain actions are taken throughout game action screens.	Obervation during guided play testing and debugging.	Yes
	Game map and multiple data displays that show players' scoring status, scoring trends, territory occupation, laydown of military forces, and status of diplomatic relationships with other players.	Observation during guided play testing and debugging.	Yes
c. Debrief	Game scoring data, scoring trends, and map display are automatically captured at end of every game turn for later analysis. By opening the "History" folder within the game's installation folder and using the Windows XP™ "View as Slide Show" function, players can replay the evolution of the game map.	Observation during guided play testing and debugging. For trend data, manually compare captured data to current game data at end of several turns. For game map display captures, manually capture screen at end of turn and compare to software-captured map.	Yes

Game Requirement	Features That Satisfy Requirement	Verification Means	Verification Complete
3. Supports multiple players			
a. Single seminar	Game can be hosted on the seminar PC and displayed on plasma screen in seminar room. Game supports 6 players maximum, allowing formation of up to 6 teams to play each country. 2-3 players per team.	Demonstration on seminar PC.	Yes
b. Multiple seminars	Seminars can be designated as the government for each of the 6 countries. Game can be hosted on the ACSC network. Once set up, each seminar can take their turn, save and exit the game, and notify the next seminar in the rotation that they can take their turn. Any PC in the seminar room can be used to access the game from the network, though the seminar PC connected to the room's plasma screen display is the likely choice. The game currently does not support multiple simultaneous players over the network.	Demonstration on seminar PC.	In progress. Pending further play testing.
4. Does not implement Artificial Intelligence	Game offers no option to play versus the computer. The only way for one player to play is to assume the role of 2 or more countries.	N/A	N/A
5. Low Cost	Software developed using Microsoft Visual Basic for Applicatons included within Microsoft Office -- no cost. All computers at ACSC licensed.	Demonstrated in project.	Yes
	Software coding completed in less than 150 man hours. Zero additional cost to the government; ~$15,000 - $20,000 if paying a software programmer.	Demonstrated in project.	Yes
6. Create and Play Different Scenarios			
a. Create	Standard game play incorporates randomization of player roles, starting total points, and rates of D, I, M, and E accumulation. Provides for varying scenarios every game.	Standard game play functions work as designed during play testing.	Yes
	Scenarios can be built via manual inputs to Microsoft Excel database. User-variable parameters include initial score distributions, rates of diplomatic, economic, military, and economic power accumulation for each country, diplomatic relationships, technologies possessed by each country, distribution of military forces, location of national capitals, and geo-political situation.	Create and load scenario in play testing.	Yes
	For games where players are asked to role play world leaders, leader profiles (accessible from the game setup screen) can be edited to provide players necessary information to act out their roles.	Edit player profile and save updated profile per operating instructions. Access new profile within game setup screen.	Yes
b. Play	Once scenario is built, single click of "Play Saved Game" button at startup will load the scenario and make it immediately available for play.	Attempt to load saved game. Verify displayed game parameters vs. scenario entered in the database.	Yes

Game Requirement	Features That Satisfy Requirement	Verification Means	Verification Complete
7. Means to show participants and players what is happening in the game			
a. During play	See features supporting Requirement 2	See Requirement 2.	
b. After play completed	See features supporting Requirement 2	See Requirement 2.	
8. Entertaining to Play	Multimedia clip used at beginning of the game as an attention-getting feature.	Subjective assessment. Survey play testers during guided and blind play testing.	In progress
	Multimedia clips used extensively throughout at key junctures of the game. Clips carefully selected to be within context of game events. Humorous clips used whenever possible.	Subjective assessment. Survey play testers during guided and blind play testing.	In progress
	Game random events displayed via text in the Master Game Message display, though still representing valid IOP relationships, contain some humorous or satirical wording.	Subjective assessment. Survey play testers during guided and blind play testing.	In progress
	Game plays a humorous video when a player is victorious.	Subjective assessment. Survey play testers during guided and blind play testing.	In progress
9. Easy to adapt, re-host software.	Software code modules all highly documented to provide future programmers visibility into code functions.	Review code listings to ensure all software routines contain accurate comments.	Yes
	Software adaptable to a stand-alone Visual Basic or C++ product with moderate amount of effort.	Compile listing of parameters that must be converted from storage in the Excel™ database to either storage in memory or in another game database format.	No

APPENDIX II

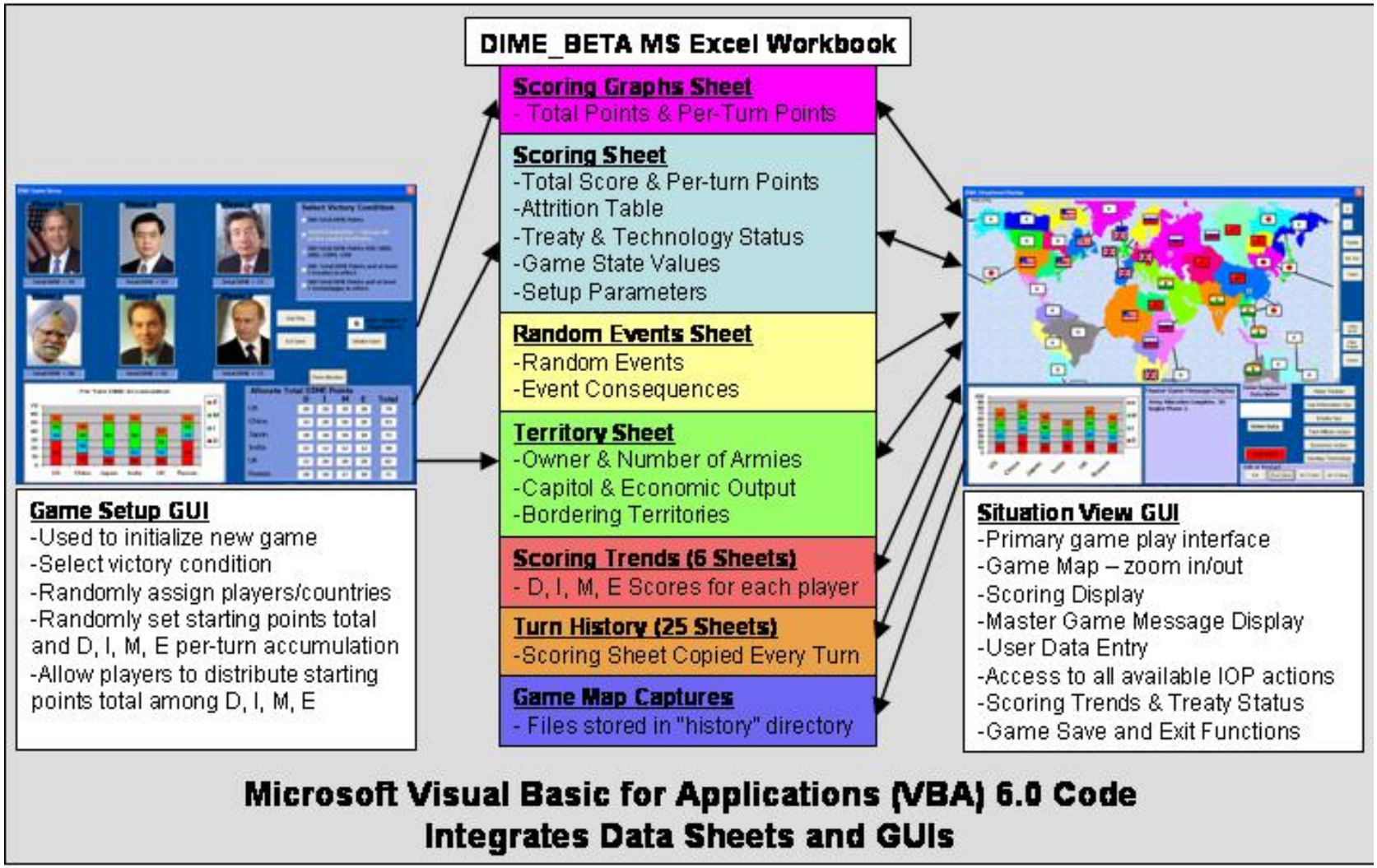
IOP Game Structure Figures

Apr 2005

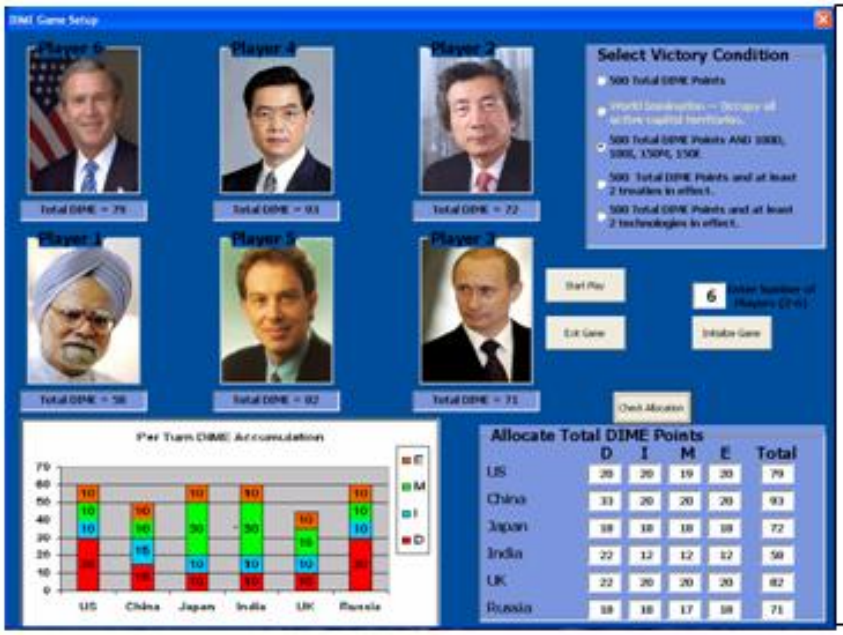
Maj Lynn Anderson

ACSC AY 2005

IOP Game Structure



Game Setup GUI



Game Setup GUI

-Used to initialize new game

-Select victory condition

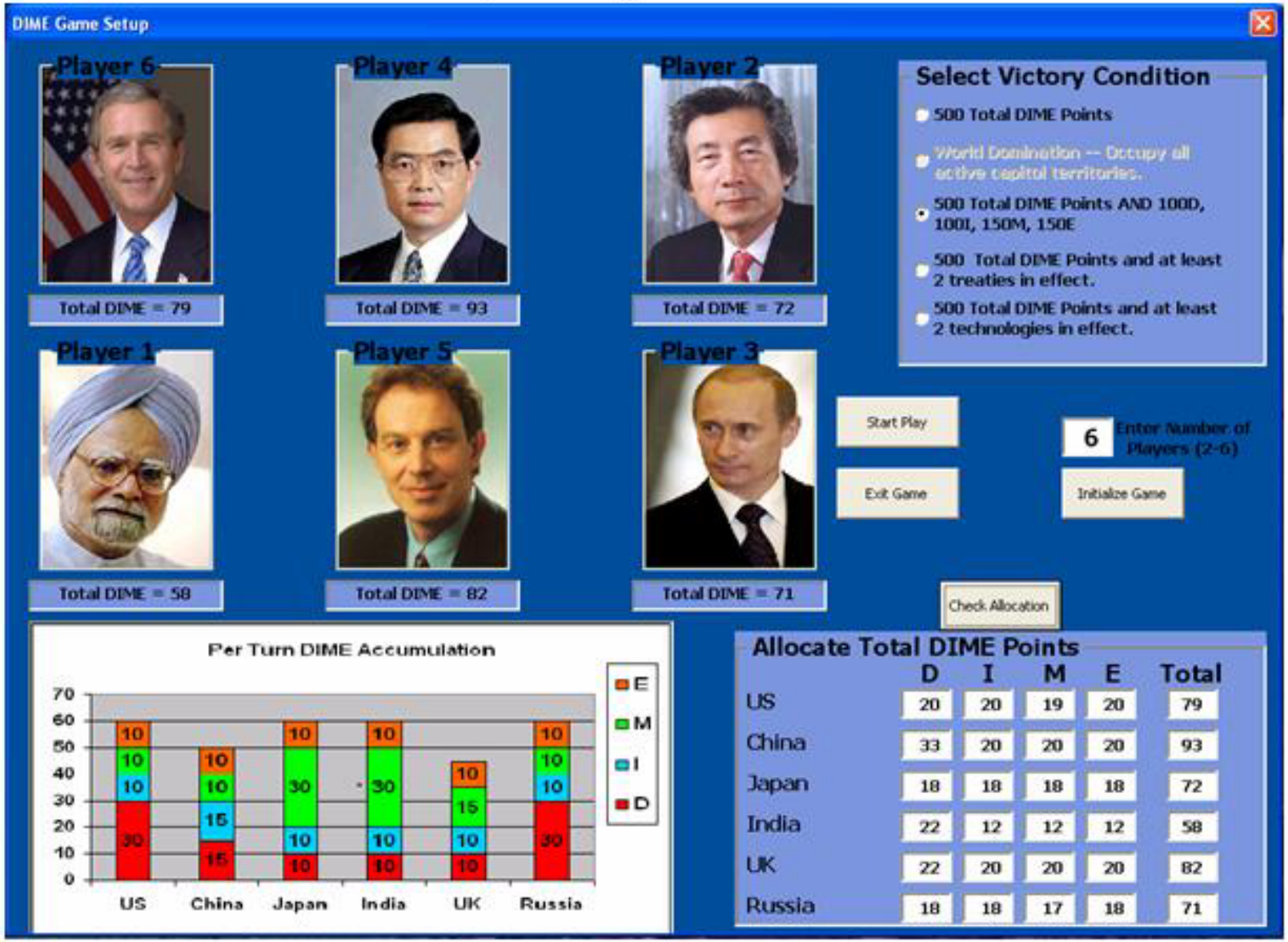
-Randomly assign players/countries

-Randomly set starting points total and **DIME** per-turn accumulation

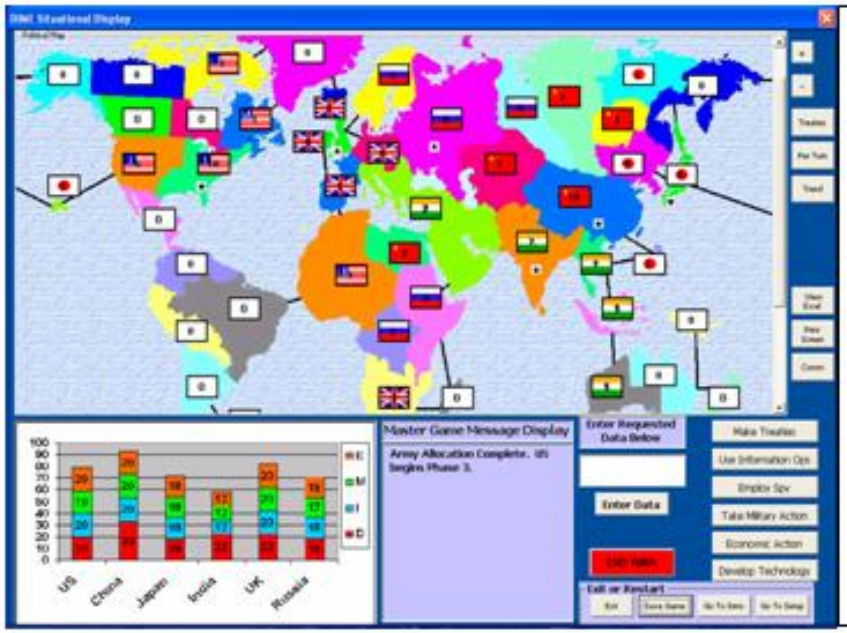
-Allow players to distribute starting points total among **D, I, M, E**

-Display linked player profiles

Game Setup Graphic User Interface



Situation View GUI



Situation View GUI

-Primary game play interface

-Game Map – zoom in/out

-Scoring Display

-Master Game Message Display

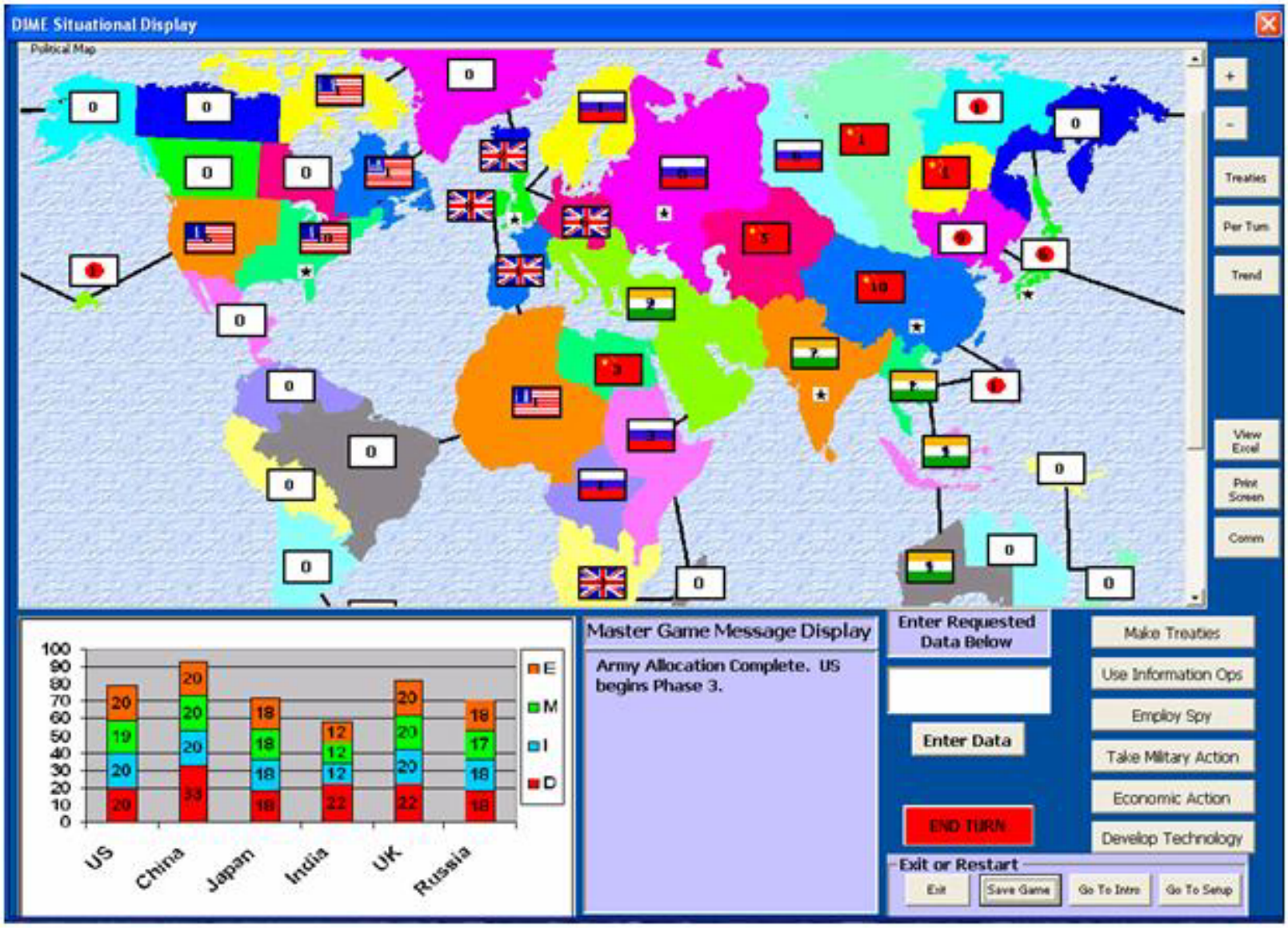
-User Data Entry

-Access to all available IOP actions

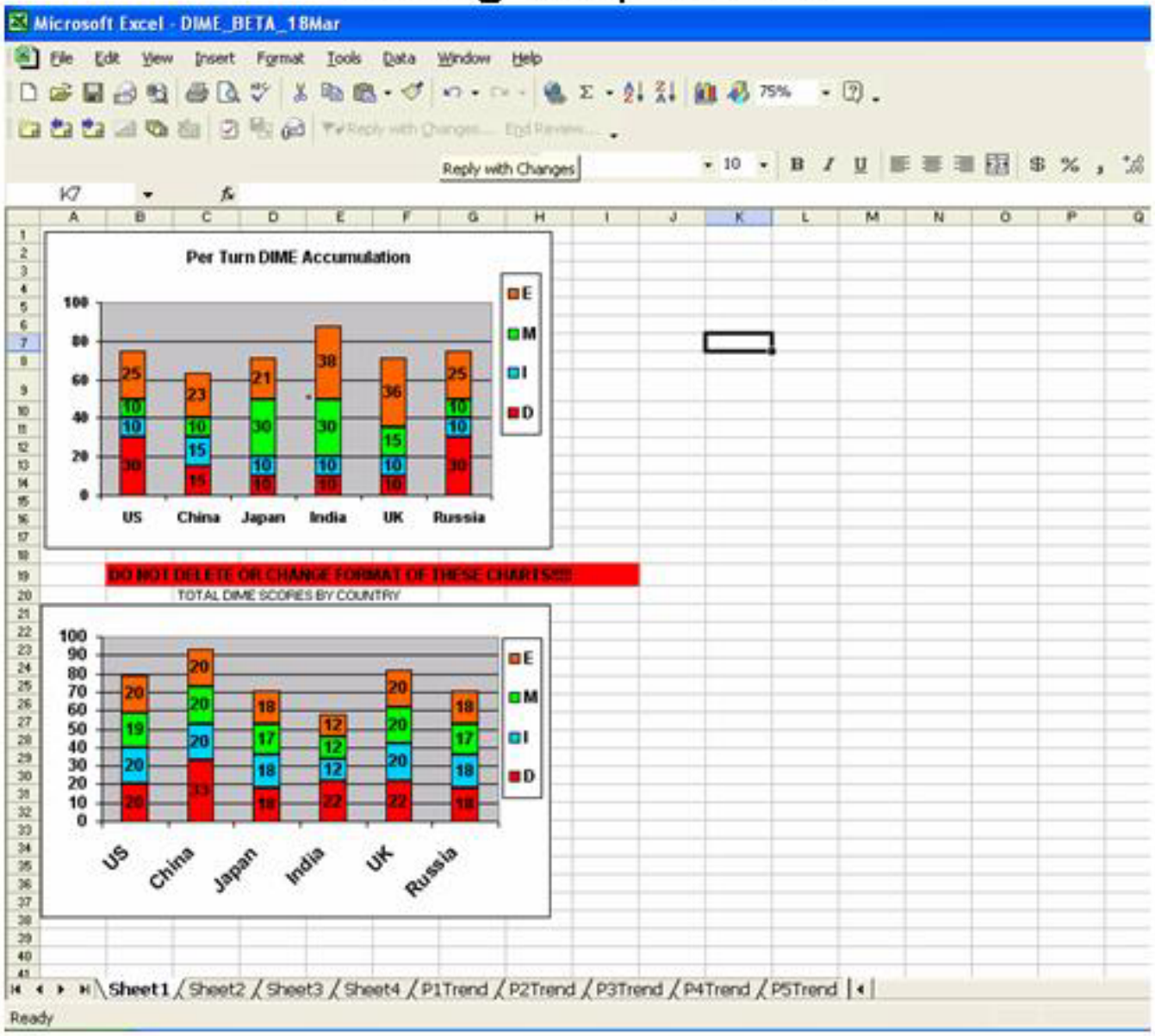
-Scoring Trends & Treaty Status

-Game Save and Exit Functions

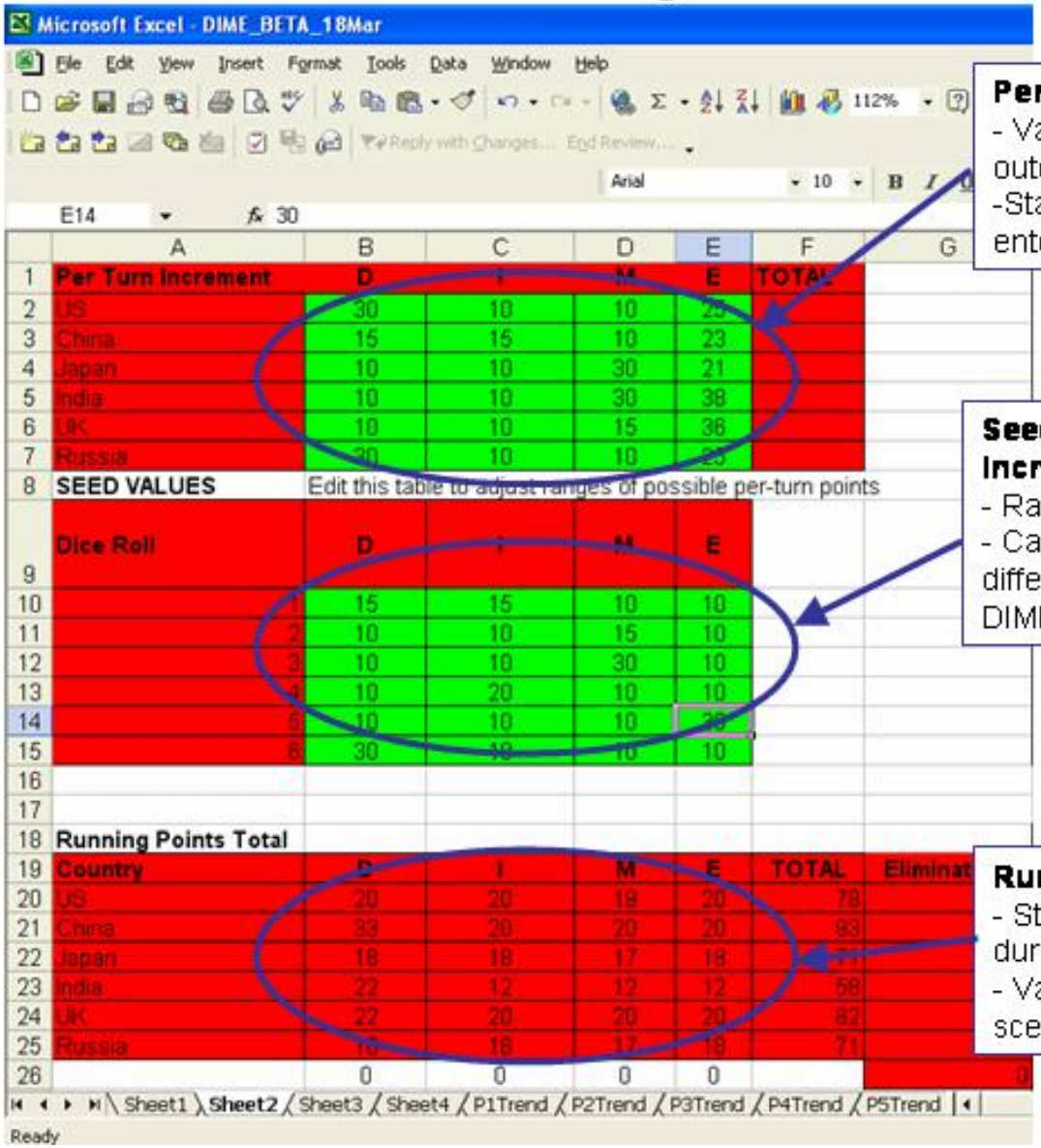
Situation View Graphic User Interface



Scoring Graph Sheet



Scoring Sheet – Part 1



	A	B	C	D	E	F	G
1	**Per Turn Increment**	**D**	**I**	**M**	**E**	**TOTAL**	
2	US	30	10	10	25		
3	China	15	15	10	23		
4	Japan	10	10	30	21		
5	India	10	10	30	38		
6	UK	10	10	15	36		
7	Russia	30	10	10	25		
8	**SEED VALUES**	Edit this table to adjust ranges of possible per-turn points					
9	**Dice Roll**	**D**	**I**	**M**	**E**		
10	1	15	15	10	10		
11	2	10	10	15	10		
12	3	10	10	30	10		
13	4	10	20	10	10		
14	5	10	10	10	25		
15	6	30	10	10	10		
16							
17							
18	**Running Points Total**						
19	**Country**	**D**	**I**	**M**	**E**	**TOTAL**	**Eliminat**
20	US	20	20	19	20	78	
21	China	33	20	20	20	93	
22	Japan	18	18	17	18	71	
23	India	22	12	12	12	58	
24	UK	22	20	20	20	82	
25	Russia	18	18	17	18	71	
26		0	0	0	0		0

Per-Turn DIME Score Increments
- Vary During Game Play based on outcomes
-Starting Values can be manually entered in scenario building

Seed Per-Turn DIME Score Increments
- Randomly Selected during setup
- Can be modified by user to allow different combinations and rates of DIME growth

Running Points Total
- Storage location for total scores during play
- Values can be manually entered in scenario building

Scoring Sheet – Part 2

TREATIES	US	China	Japan	India	UK	Russia	Total Treaties in Effect
US	0	6	6	6	6	6	0
China	6	0	6	6	6	6	0
Japan	6	6	0	6	6	6	0
India	6	6	6	0	6	6	0
UK	6	6	6	6	0	6	
Russia	0	6	6	6	6	0	

Technology Status	Spy	Mass Media	Air Defense	Industrial Tech	Diplomatic Training	Satellites	Airborne Forces	Fast Cargo Ships	SUM
US									0
China									0
Japan									0
India									0
UK									0
Russia									0

Treaty Bonus/Penalty Data: Change here to change consequences of treaties.

Type	D_initial	I_initial	M_initial	E_initial	D_perturn	I_perturn	M_perturn	E_Perturn
1								
Offeror	-15				1	1	1	1
Acceptor					1	1	1	1
2								
Offeror	-10				1			1
Acceptor					1			
3								
Offeror	-5				1			
Acceptor					1			
4								
Offeror	-20							
Acceptor								
5								
Offeror	-20			-20				
Acceptor								
6								
Offeror				-10	-1	-1	-1	-1
Acceptor				-10	-1	-1	-1	-1

Sheet1 | Sheet2 | Sheet3 | Sheet4 | P1Trend | P2Trend | P3Trend | P4Trend | P5Trend

Treaty Status
-Tracks state of relations between nations
-Used in variety of calculations, including movement and attack
-Can be modified in scenario building

Technologoy Status
-Tracks what capabilities each nation has developed
-Used in variety of calculations, including movement and attack, information ops, economic output
-Can be modified in scenario building

Treaty Bonus/Penalty Data
-Used to set the costs and benefits of establishing or breaking treaties
-Modify only if different impacts are desired for a particular scenario

Scoring Sheet – Part 3

	A	B	C	D	E	F
28	Initial Territories/Player	4				
29	Maximum Game Turns	10				
30						
31	Leader Personality	Nation	Icon Filename			
32	Leader 1	US	US.gif			
33	Leader 2	China	China.gif			
34	Leader 3	Japan	Japan.gif			
35	Leader 4	India	India.gif			
36	Leader 5	UK	UK.gif			
37	Leader 6	Russia	Russia.gif			
38						
39	Initial IOP Points	D	I	M	E	
40	US	20	20	15	20	
41	China	33	20	20	20	
42	Japan	18	18	18	18	
43	India	22	12	12	12	
44	UK	22	20	20	20	
45	Russia	18	18	17	18	
46						
47						
48	Combat Odds & Attrition	% Victory	Attrition	Attrit High		
49	5.0	99	10	15		
50	4.0	95	10	25		
51	3.0	75	10	40		
52	2.0	45	30	65		
53	1.0	35	50	75		
54	0.5	10	50	75		
55	0.3	1	75	90		
56	Psyops victory adder	5				
57						
58						
59	Save Game Parameters					
60	Phase	3				
61	Turn	1				
62	Player	1				
63	Playername	US				
64	Number of Players	6				
65	Armiesleft 1					
66	Armiesleft 2					
67	Armiesleft 3					
68	Armiesleft 4					
69	Armiesleft 5					
70	Armiesleft 6					
71						
72	Victory Condition	4				

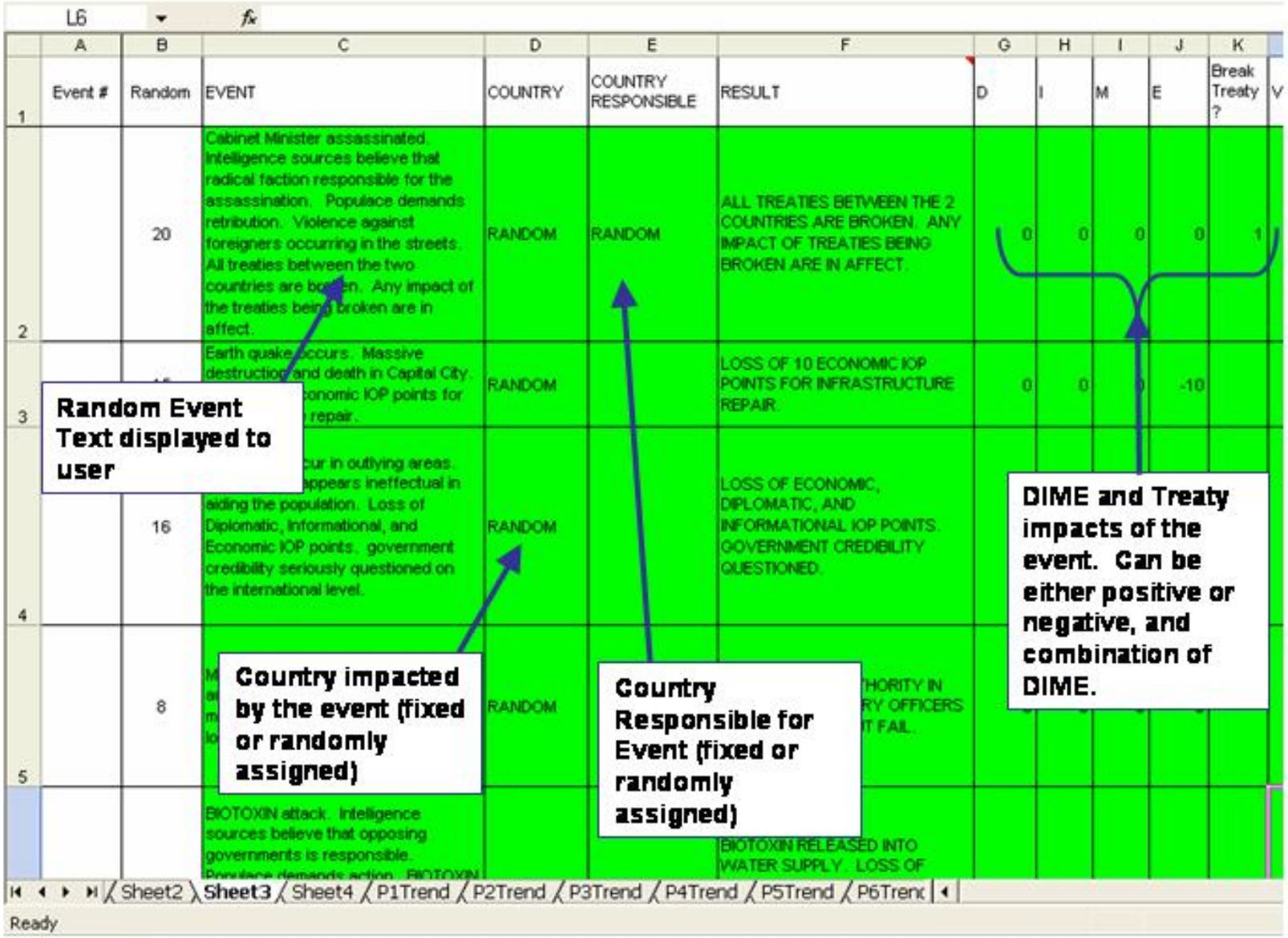
Game Setup Parameters
-Set number of territories to be allocated to each player
-Set maximum number of game turns (must be less than 25)
-Set/change Nation names and flag icons (not enabled in current version)

Initial IOP Points
-Stores starting DIME points allocation
-Currently not used by the software

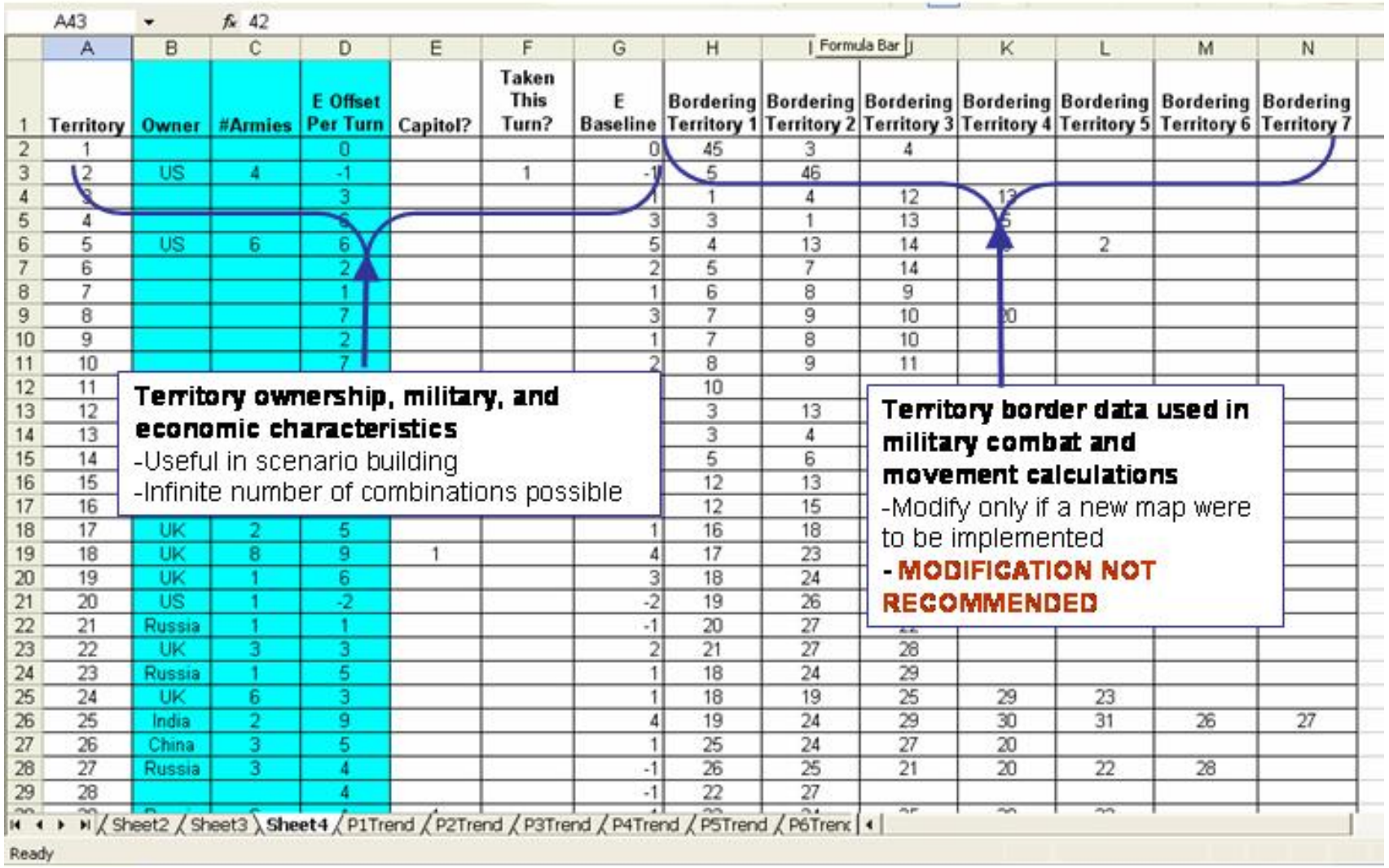
Combat Odds & Attrition Table
-Set combat victory odds based on force ratios
-Set range of attrition values possible for engagement
-Set percentage increase in attacker odds if Psyops used

Save Game Parameters
-Stores information necessary for a saved game to be reloaded and return to the correct turn
-Useful in scenario building
-"Armiesleft" Parameter currently not used

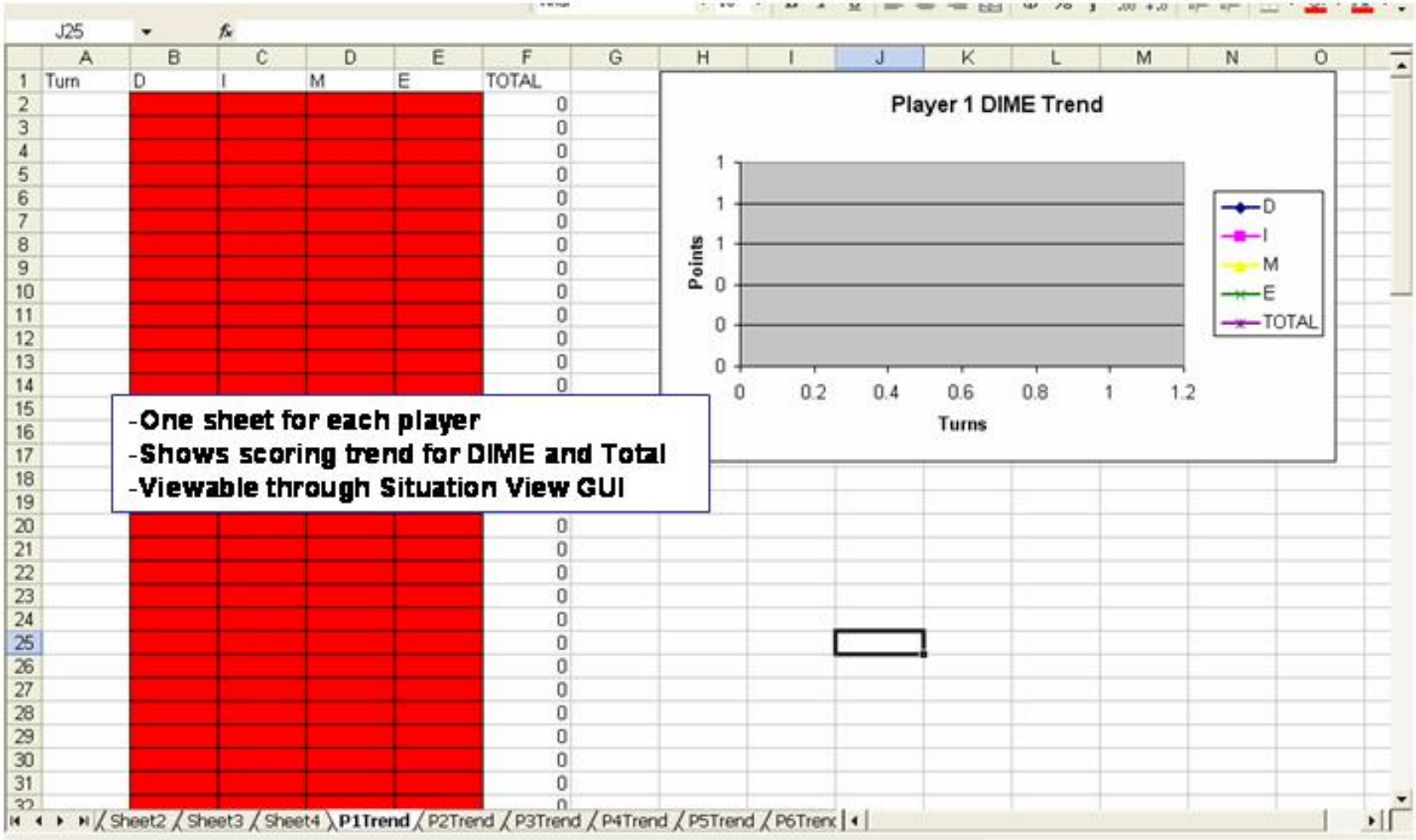
Random Events Sheet



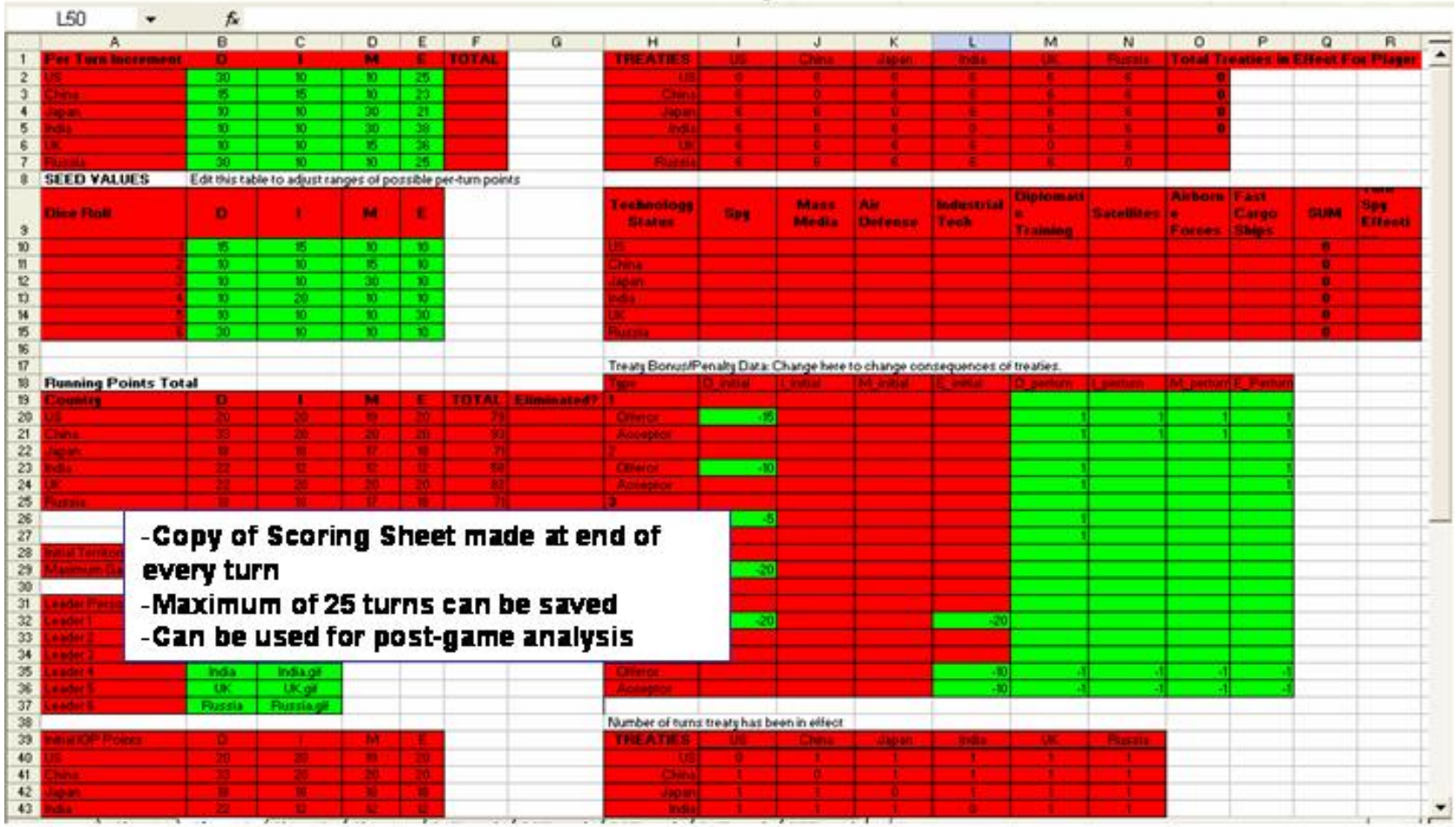
Territory Sheet



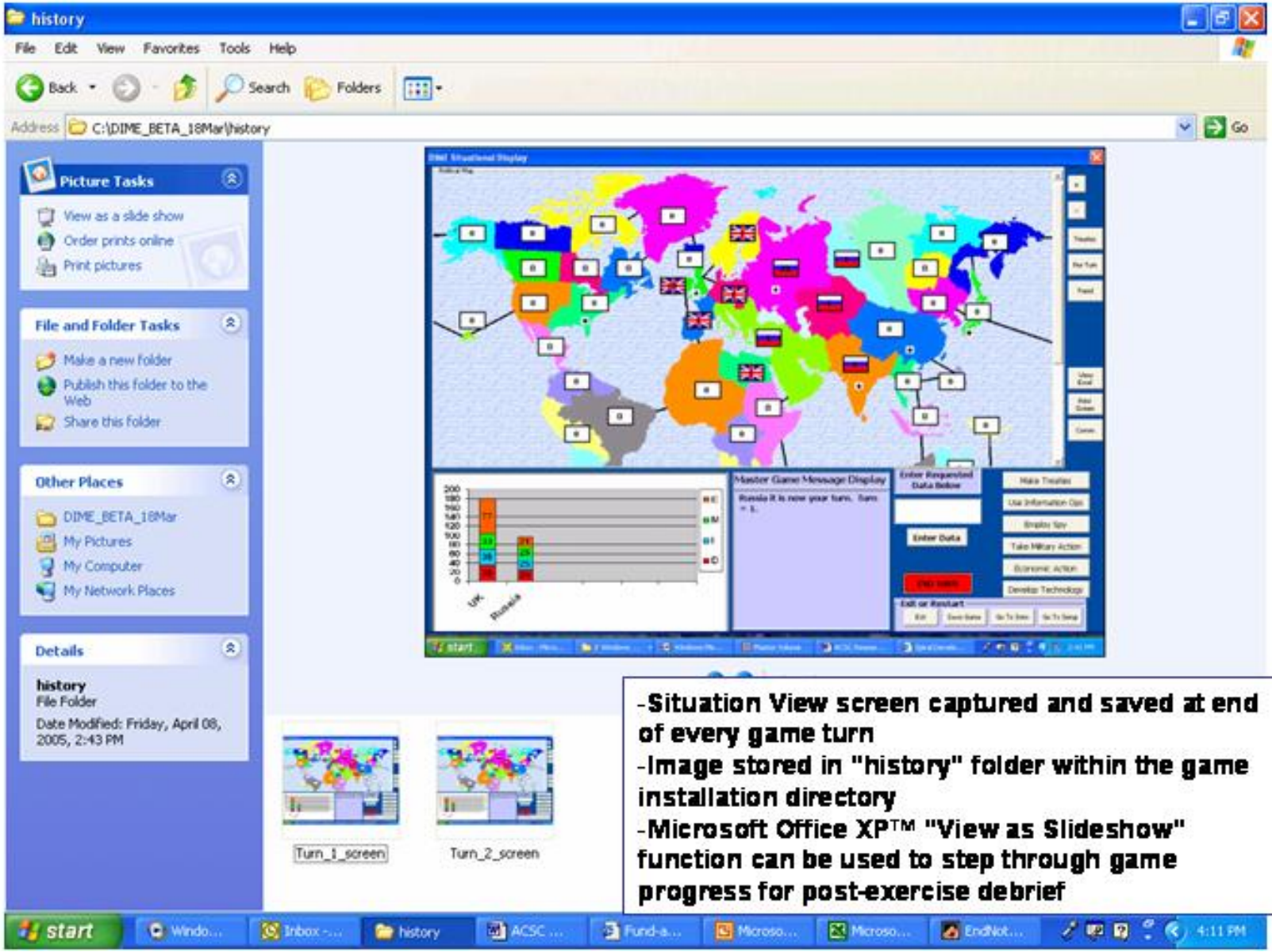
Player Trend Sheet



Turn History Sheet



Game Map Captures



APPENDIX III

Quick Reference for Installation/Use of the Instruments of Power (IOP) Game

COMPUTER SETUP AND SOFTWARE INSTALLATION

1. **System Requirements.** The host personal computer must have the following software installed for the game to run properly:
   - Operating System: Microsoft® Windows® XP Home or Professional Edition*
   - Microsoft® Excel® 2002 or later*
   - Microsoft® Windows Media Player 9.0 or later

** The application may work with earlier versions, but has not been tested with them to date. Use with earlier versions could result in unexpected/undesirable application behavior*

2. **Screen Resolution.** For best viewing, the host computer's screen resolution should be set to a minimum of 1024 x 768. To check/change this setting:
   - On the Windows Desktop, click the right mouse button
   - On the pop-up menu that appears, left-click on "Properties"
   - A dialogue box will appear. Click on the "Settings" tab
   - Find the "Screen Resolution" scrollbar (left center of the box). If necessary, slide it to the right to increase screen resolution to at least 1024 x 768.
   - Click on the "OK" button to apply the new resolution setting and close the dialogue box

3. Double click on **DIME_BETA.zip** file and follow instructions to extract all files to the desired directory. All files **MUST** be in the same directory for proper game operation. This directory can either be on a local (C:) or network drive.

4. Open Microsoft® Excel®. Go to the Tools=>Macro=>Security dropdown menu. If it isn't already, set your security level to "Medium." This will prompt you before Excel® runs a worksheet with an auto-running Macro.

INITIALIZE AND PLAY GAME

1. Once extracted, minimize or close all of your other applications (not required, but helps displays work more smoothly on slower machines). Double-click on the **DIME_BETA_18Mar.xls** file to open it.

2. A Dialogue box will appear. Click the "Enable macros" button.

3. A message box will appear (talks about the application using a "potentially dangerous Active X control.). Click "OK" (don't worry—it won't hurt anything.).

4. At this time the Introduction screen should appear. Click on "Start New Game" to begin initialization of the game.

5. A short video should play and automatically disappear. If you want to skip the video and go straight to playing, click the "continue" button.

6. The Game Setup screen should appear.
    - Click on one of the radio buttons in the top right to select victory criteria.
    - Enter the number of players (2-6)
    - Click the "Initialize Game" button.

7. After several seconds, each player will be assigned a country and a beginning total DIME score immediately below their box. It will also show a bar graph with the number of DIME points each player will gain per turn. All of these are randomly assigned.

8. In the lower right of the screen, each player enters how much of their total score they want to allocate to D-I-M-E respectively. Once all players have entered their allocations, click the "Check Allocation" button. If your allocation doesn't add up to your total, the "Total" box will have a red background and you will be unable to click the "Start Play" button. Adjust and re-enter values, and click the "Check Allocation" button again.

9. When all allocations are correct, the "Start Play" button will be activated. Click on it to begin play, or click on the "Initialize Game" button if you wish to start over.

10. The "Situation View" screen will appear. Read the "Master Game Message Display" for prompts and instructions on necessary actions. Refer to the game rules for detailed descriptions of the steps involved.

11. To save your game for later play, click the "Save Game" button. **IMPORTANT: When saving a game, make sure that you give the spreadsheet a new name and save it in the same directory as your unzipped installation files. The spreadsheet must be in the same directory as the other files for the game to work.**

12. To end play, click on the "Exit" button. The software will ask you if you want to save changes to the game file. As in 15 above, if you want to resume play later, give the file a new name and save it in the installation directory. If not, click on "No."

LOAD AND PLAY A SAVED GAME

1. Find the Excel® file for the saved game in your installation directory and open it.

2. When the "Introduction" screen appears, click on the "Play Saved Game" button.

3. The "Situation View" Screen will appear. Follow the prompts in the "Master Game Message Display" to resume play of the saved game.

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